

Gymnothorax longinquus (Whitley, 1948) (Anguilliformes, Muraenidae), Long Moray: a first record from Malaysia

Danial Hariz Zainal Abidin¹, Siti Azizah Mohd. Nor^{1,2}, Ying Giat Seah^{3,4}, Mohd Sharol Ali³, Nur Athirah Abdul Latiff³, Tun Nurul Aimi Mat Jaafar³

¹ School of Biological Sciences, Universiti Sains Malaysia, 11800, Penang, Malaysia

² Institute of Climate Adaptation and Marine Biotechnology, Universiti Malaysia, Terengganu, 21030, Kuala Nerus, Terengganu, Malaysia

³ Faculty of Fisheries and Food Science, Universiti Malaysia Terengganu, 21030, Kuala Nerus, Terengganu, Malaysia

⁴ South China Sea Repository and Reference Centre, Institute Oceanography and Environment, Universiti Malaysia Terengganu, Kuala Nerus, Terengganu, Malaysia

Corresponding author: Tun Nurul Aimi Mat Jaafar (tun_aimi@umt.edu.my)

Abstract. We report the first record of *Gymnothorax longinquus* (Whitley, 1948), Long Moray, (Anguilliformes, Muraenidae), from the east coast of Peninsular Malaysia. A single specimen was collected during a bottom-trawl survey in the exclusive economic zone off Malaysia in the South China Sea. *Gymnothorax longinquus* was previously recorded from populations in Australia, Thailand, the Philippines, and Vietnam. We present detailed morphometric and meristic data, along with brief diagnostic characters.

Key words. Distribution, exclusive economic zone, moray-eel, new record, South China Sea

Zainal Abidin DH, Mohd Nor SA, Seah YG, Ali MS, Abdul Latiff NU, Mat Jaafar TNA (2024) *Gymnothorax longinquus* (Whitley, 1948) (Anguilliformes, Muraenidae), Long Moray: a first record from Malaysia. Check List 20 (1): 126–131. <https://doi.org/10.15560/20.1.126>

INTRODUCTION

The exclusive economic zone of Peninsular Malaysia, spanning nearly 130,000 km² in the South China Sea (Nadira et al. 2019), is a marine biodiversity hotspot with immense ichthyofaunal diversity (Allen 2008; Myers et al. 2000). Situated within the Coral Triangle, this waters harbor over 3,000 recorded fish species from more than 250 families (Allen et al. 2000; Froese and Pauly 2023). This exceptional diversity results from the region's tropical climate, extensive coral reefs, and ocean currents which mix the waters of the Pacific and Indian oceans (Du et al. 2023). Muraenids are common tropical reef fishes, but their cryptic behavior leads to under-appreciation of their abundance and ecology (Böhlke and McCosker 2001). Information on muraenids within Malaysian waters remains limited. Chong et al. (2010) documented 16 muraenid species across five genera in Malaysian waters based on historical data, but these authors did not list the species by name. The most recent assessment by Loh et al. (2015) revealed 33 species from six muraenid genera in Malaysian waters, with *Gymnothorax* Bloch, 1795 being the most species-rich genus with 18 recorded species. Further surveys are required to fully characterize muraenid diversity and distributions in this globally significant marine biodiversity hotspot. *Gymnothorax longinquus* (Whitley, 1948) is a rare, shallow-water eel with few records since its initial description from Queensland, Australia (Whitley, 1948). Additional specimens have been documented from scattered locations off northern Australia (Böhlke and McCosker 2001) and southern Vietnam (Huang et al. 2020). Two additional specimens from Thailand and the Philippines were originally misidentified as *G. pseudothyroideus* (Bleeker, 1853) and *Gymnothorax* sp., respectively, but have now been confirmed as *G. longinquus* (Imamura 2013; Hibino 2017). Our record constitutes the first documented occurrence of *G. longinquus* from the east coast of Peninsular Malaysia, adding to the limited information on distribution of this little-known moray eel species in the Indo-Pacific region.



Academic editor: Kar-Hoe Loh

Received: 2 November 2023

Accepted: 9 January 2024

Published: 18 January 2024

METHODS

Our new record was collected during a scientific survey on 1 July 2016 aboard the MV *SEAFDEC 2* research vessel, using a 40 mm cod end-mesh bottom trawl. Trawling lasted 60 min at a speed of 3.2 knots covering 3.1 nautical miles. The specimen was fixed, photographed, and preserved following Motomura et al. (2013). Morphometrics and terminology of morphological descriptions follow Huang et al. (2020). The specimen was measured to 0.01 mm with vernier calipers. Total length is stated in millimeters; other measurements

are expressed as percentages of either total length or head length. Species identification followed Böhlke and McCosker (2001) and Huang et al. (2020). The specimen was deposited at the South China Sea Repository and Reference Center, Universiti Malaysia Terengganu, Malaysia (**UMTF**).

DNA-based identification utilized 650 base pair cytochrome c oxidase subunit I (COI) gene fragments amplified with FishF1 and FishR1 universal primers (Ward et al. 2005). DNA extraction and PCR thermal profiles followed Zainal Abidin et al. (2021). Species confirmation was done by GenBank and BOLD COI sequence comparison using a 98% similarity threshold for species assignment. The new COI sequence generated from our specimen was submitted to GenBank and BOLD under accession numbers OR922647 and BOLD ID: DBEEZ217-23, respectively.

RESULTS

Class Actinopterygii
Order Anguilliformes
Family Muraenidae
Genus *Gymnothorax* Bloch, 1795

Gymnothorax longinquus (Whitley, 1948)

Figure 1, Table 1

New record. MALAYSIA – **Johor** • off South China Sea; 01°57'28.8"N, 104°57'28.8"E ; 59 m depth; 1.VII.2016; Mat Jaafar TNA leg.; bottom trawl; 1 specimen, 338.0 mm TL; UMTF 10742, GenBank OR922647.

Identification. The specimen was identified as *G. longinquus* based on the following combination of characters, which matched the diagnostic features given by Böhlke and McCosker (2001) and Huang et al. (2020): body elongate and dark brown, depth at anus less than depth at gill opening. Head pores typical with fine brown rims, 3 supraorbital pores, 4 infraorbital pores, 6 mandibular pores, and 2 branchial pores above and before gill opening. Dorsal-fin origin above the first branchial pore. Gill opening slightly below midline of body. Short anterior nostril and blunt snout. Anus slightly posterior to mid-body. Tail tapering. Fins dark with black margin. Maxillary teeth uniserial with an inner row of 3 teeth and outer row of 14 teeth, the first 4 teeth of outer row enlarged and elongate anteriorly, followed by smaller teeth posteriorly that do not decrease in size. Peripheral intermaxillary teeth 6, with 3 long median fangs. Vomerine teeth hidden in our specimen. Dentary teeth 21, with first 4 posterior teeth large and long, and other teeth progressively smaller towards the posterior.

Gymnothorax longinquus differs from *G. pseudothyrsoides* by having shorter teeth (vs. slender and pointed) and dark fin margin (vs. white fin margin at posterior tail) (Chen et al. 1994). In comparison to *G. taiwanensis*, *G. longinquus* has uniserial dentary and vomerine teeth; dentition is biserial in *G. taiwanensis* (Chen et al. 2008). *Gymnothorax longinquus* can be differentiated from *G. tile* (Hamilton, 1822) by having a row of peripheral intermaxillary teeth compared to *G. tile* with two rows (Mohapatra et al. 2017). Detailed morphometrics and teeth counts are provided in Table 1.

The COI sequence of our new record had been compared with sequences in GenBank with 100% similarity to *G. longinquus* (MK777090, MN39915–MN39918) from southern Vietnam (Huang et al. 2020).

Figure 1. *Gymnothorax longinquus* (UMTF 10742), collected in the waters of the east coast of Peninsular Malaysia.



Table 1. Range variations in morphometric measurements and teeth counts of *G. longinquus* in comparison to Huang et al. (2020).

Character	Present study, UMTF10742	Huang et al. 2020
Total length (mm)	338.00	554–702
As % of total length		
Trunk length	40.40	37.3–38.4
Body depth at gill opening	6.37	5.6–7.3
Body depth at anus	5.30	4.5–5.7
Pre-dorsal length	10.86	8.5–10.2
Pre-anal length	57.71	50.5–51.9
Head length	17.31	12.8–13.4
As % of head length		
Upper jaw length	42.10	39.7–43.2
Lower jaw length	41.90	40.1–44.1
Snout length	15.80	15.2–16.8
Interorbital width	12.30	11.9–14.6
Eye diameter	8.90	7.3–9.2
Counts		
Peripheral intermaxillary teeth	6	5–7
Median intermaxillary teeth	3	1–3
Outer maxillary teeth	14	11–16
Inner maxillary teeth	3	—
Vomerine teeth	hidden	2–12
Dentary teeth	21	18–22

DISCUSSION

The discovery of *G. longinquus* from Malaysian waters adds a new locality record and helps elucidate the distribution of this rare eel. This species’ scattered records limited to northern Australia (Böhlke and McCosker 2001) may be partly an artifact of inadequate sampling and taxonomic expertise across the region. Misidentifications from Thailand fish markets and other areas (Böhlke and McCosker 2001; Imamura 2013) likely contributed to perceived distributional gaps. However, the recent documentation of *G. longinquus* in southern Vietnam (Huang et al. 2020) fills some of these gaps and confirms a geographic range that extends towards the Gulf of Thailand. Together with the Philippine record (Hibino 2017), our new Malaysian occurrence provides evidence that *G. longinquus* has a wider distribution across Southeast Asia than previously known. Disjunct distributions often arise from limited sampling and taxonomic skills, rather than true disjunction of populations; this is especially for cryptic species like moray eels. Additionally, population connectivity is not an issue for moray eels, given their long pelagic larval duration driven by leptocephalus larvae, and many studies have shown large-scale genetic homogeneity across ocean basins (e.g. Reece et al. 2011; Huang et al. 2018; Li et al. 2021). The presence of *G. longinquus* populations across the South China Sea supports a broad western Pacific range. Continued documentation of verified specimens will further clarify the biogeography and population structure of this rare moray, which appears more widely distributed than previously recognized.

Notably, our new record represents the first validated *G. longinquus* occurrence from Malaysian waters, approximately 1400 km from the nearest documented populations in Thailand (Imamura 2013) (Figure 2). Earlier Australian collections were scattered and lacked clear Western Pacific–Coral Triangle connectivity. The location of our specimen from the Peninsular Malaysia exclusive economic zone helps bridge distribution gaps between north Australian and Thailand records. Despite some habitat gradients across this region, the diverse ecosystems along the eastern Johor coast provide ample suitable niches that likely support stable local populations of this eel species. Specifically, the numerous nearshore islands, coral reefs, seagrass meadows, and mangrove estuaries (Jaaman and Mohamed 2013) offer prime nursery areas rich in potential prey like crustaceans and small fishes. Our trawl-caught specimen was accompanied by a varied benthic fauna, including annelids, arthropods, molluscs, echinoderms, and numerous demersal fishes from the families Nemipteridae, Leiognathidae, Synodontidae, Mullidae, Priacanthidae, and Soleidae.

Additional undocumented populations could be present in other adjacent Coral Triangle nations near the known occurrences. Comprehensive surveys and morphological examinations are needed to fully elucidate the distribution patterns and ecology of this rare muraenid eel. Our finding highlights the value

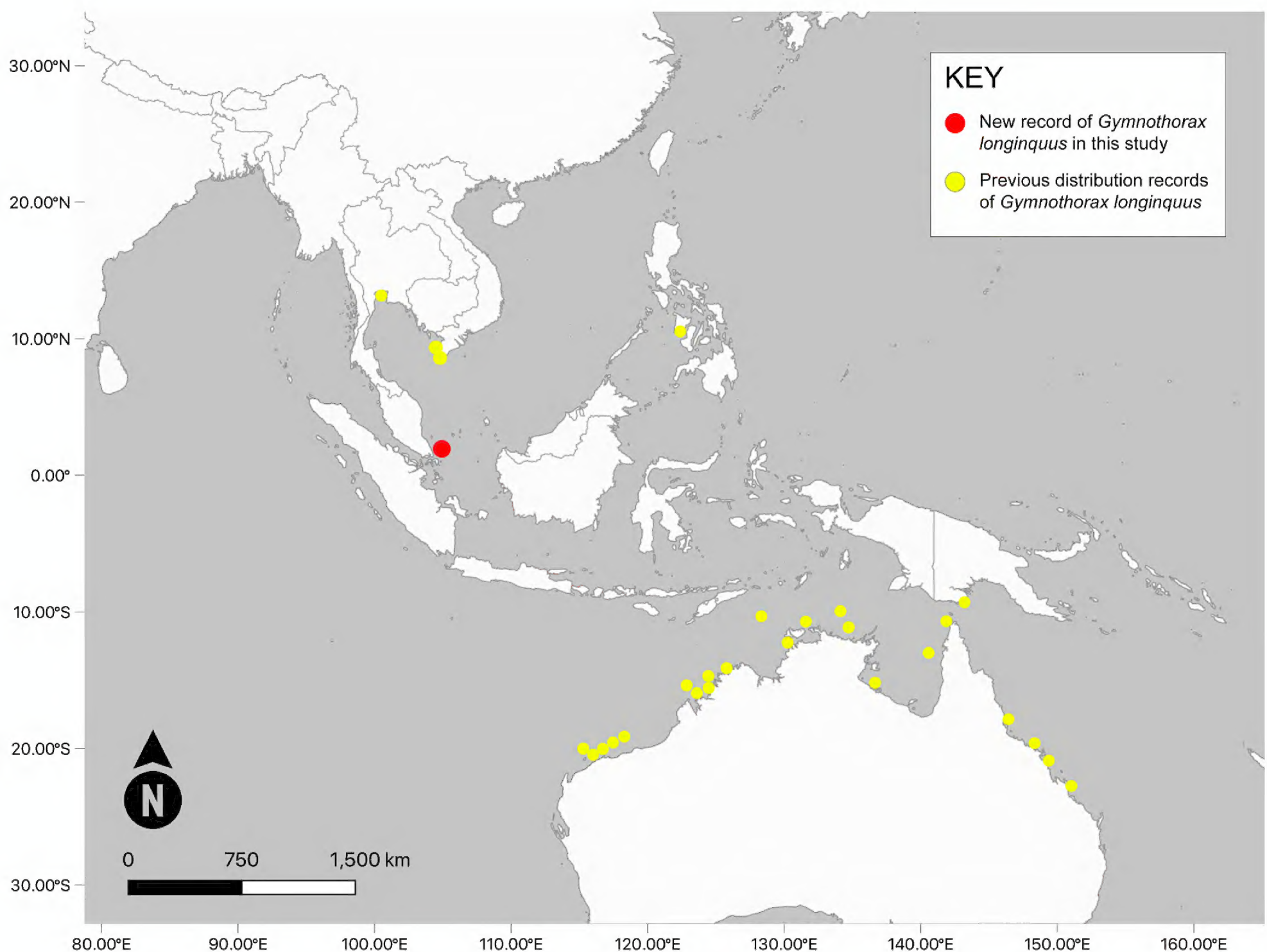


Figure 2. Distribution map of *Gymnothorax longinquus*. Yellow dots show the previous records based on gbif.org, Imamura (2013), Hibino (2017), and Huang et al. (2020). The red dot is the new record presented in this study.

of exploratory sampling in the biodiverse South China Sea. Further expeditions in this globally significant marine region could likely reveal additional range extensions and previously undocumented populations of tropical marine fauna.

ACKNOWLEDGEMENTS

We thank the Department of Fisheries Malaysia for the invitation to participate in the East Coast Peninsular Malaysia (ECPM) EEZ Offshore Demersal Survey. We thank all the technical staff from the SEAFDEC Training Department Bangkok assisting in samples collection, as well as the entire staff of the Faculty of Fisheries and Food Science and the South China Sea Repository and Reference Centre, Universiti Malaysia Terengganu for their valuable research assistance. We also express our gratitude to the reviewers and academic editor.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

Danial Hariz Z.A. was supported by a postdoctoral fellowship (JPNP.AUPE002) from Universiti Sains Malaysia.

Author contributions


Conceptualization: DHZA, SAMN, TNAMJ. Methodology: MSA, NAAL. Investigation and validation: YGS, TNAMJ. Funding acquisition: SAMN. Visualization: DHZA. Writing – original draft: DHZA, TNAMJ, SAMN. Writing – review and editing: DHZA, SAMN, YGS, MSA, NAAL, TNAMJ.

Author ORCID iDs

Danial Hariz Zainal Abidin  <https://orcid.org/0000-0002-2654-6306>

Siti Azizah Mohd. Nor  <https://orcid.org/0000-0002-9890-9612>

Ying Giat Seah  <https://orcid.org/0000-0002-2976-444>

Nur Athirah Abdul Latiff  <https://orcid.org/0009-0004-9025-406X>

Tun Nurul Aimi Mat Jaafar  <https://orcid.org/0000-0002-3032-0545>

Data availability

Data that support the findings of this study are available in the main text, GenBank (accession number: OR922647), and BOLD (ID: DBEEZ217-23).

REFERENCES

- Allen GR** (2008) Conservation hotspots of biodiversity and endemism for Indo-Pacific coral reef fishes. *Aquatic Conservation: Marine and Freshwater Ecosystems* 18 (5): 541–556. <https://doi.org/10.1002/aqc.880>
- Allen GR, Amaoka K, Anderson Jr WD, Bellwood DR, Bohlke EB, Bradbury M G, Carpenter KE, Caruso J H, Cohen A C, Cohen D M, Collette BB** (2000) A checklist of the fishes of the South China Sea. *The Raffles Bulletin of Zoology* 8: 569–667.
- Böhlke E, McCosker JE** (2001) The moray eels of Australia and New Zealand, with the description of two new species (Anguilliformes: Muraenidae). *Records of the Australian Museum* 53 (1): 71–102. <https://doi.org/10.3853/j.0067-1975.53.2001.1325>
- Chen HM, Shao KT, Chen CT** (1994) A review of the muraenid eels (Family Muraenidae) from Taiwan with descriptions of twelve new records. *Zoological Studies* 33 (1): 44–64.
- Chen HM, Loh KH, Shao KT** (2008) A new species of moray eel, *Gymnothorax taiwanensis* (Anguilliformes: Muraenidae) from eastern Taiwan. *The Raffles Bulletin of Zoology* 19: 131–134.
- Chong V, Lee P, Lau C** (2010) Diversity, extinction risk and conservation of Malaysian fishes. *Journal of Fish Biology* 76 (9): 2009–2066. <https://doi.org/10.1111/j.1095-8649.2010.02685.x>
- Du Y, Wang F, Wang T, Liu W, Liang L, Zhang Y, Chen Y, Liu J, Wu W, Yu K, Zhang** (2023) Multi-scale ocean dynamical processes in the Indo-Pacific Convergence Zone and their climatic and ecological effects. *Earth-Science Reviews* 237 (3): 104313. <https://doi.org/10.1016/j.earscirev.2023.104313>
- Froese R, Pauly D** (2023) FishBase. <http://www.fishbase.org>. Accessed on: 2023-09-01
- Hibino Y** (2017) *Gymnothorax* sp. P. 30. in: Motomura H, Alama UB, Muto N, Babaran R, Ishikawa S (Eds.) Commercial and bycatch market fishes of Panay Island, Republic of the Philippines. Kagoshima University Museum, Kagoshima, Japan; University of the Philippines Visayas, Iloilo, Philippines; Research Institute for Humanity and Nature, Kyoto, Japan.
- Huang WC, Chang JT, Liao C, Tawa A, Iizuka Y, Liao TY, Shiao JC** (2018) Pelagic larval duration, growth rate, and population genetic structure of the tidepool snake moray *Uropterygius micropterus* around the southern Ryukyu Islands, Taiwan, and the central Philippines. *PeerJ* 6: e4741. <https://doi.org/10.7717/peerj.4741>
- Huang WC, Thu PT, Liao TY** (2020) A new record of the long moray, *Gymnothorax longinquus* (Actinopterygii: Anguilliformes: Muraenidae), from southern Vietnam, supporting the uncertain record in the Gulf of Thailand. *Acta Ichthyologica et Piscatoria* 50 (2): 201–207. <https://doi.org/10.3750/aiep/02790>
- Imamura H** (2013) *Gymnothorax pseudothyrsoides*. P. 21 in: Yoshida T, Motomura H, Musikasinthorn P, Matsuura K (Eds.) Fishes of northern Gulf of Thailand. National Museum of Nature and Science, Tsukuba; Research Institute for Humanity and Nature, Kyoto; Kagoshima University Museum, Kagoshima, Japan.
- Jaaman S, Mohamed CAR** (2013). Marine mammals in the waters of east coast Johor, Malaysia. *ASM Science Journal* 8: 143–149.
- Li Y, Zhang L, Song P, Shan B, Lin L** (2021) Genetic homogeneity detectable in the sedentary moray eel *Gymnothorax minor* based on mitochondrial DNA analysis. *Regional Studies in Marine Science* 41: 101504. <https://doi.org/10.1016/j.rsma.2020.101504>
- Loh KH, Hussein MAS, Chong VC, Sasekumar A** (2015). Notes on the moray eels (Anguilliformes: Muraenidae) of Malaysia with two new records. *Sains Malaysiana* 44 (1): 41–47. <https://doi.org/10.17576/jsm-2015-4401-06>
- Mohapatra A, Smith DG, Ray D, Mishra SS, Mohanty SR** (2017) *Gymnothorax pseudotile* sp. nov. (Muraenidae: Muraeninae) from Bay of Bengal India. *Zootaxa* 4286 (4): 586–592. <https://doi.org/10.11646/zootaxa.4286.4.11>
- Motomura H, Ishikawa S, Takagi A, Ogata Y** (Eds.) (2013) Fish collection building and procedures manual. English edition. The Kagoshima University Museum, Kagoshima and the Research Institute for Humanity and Nature, Kyoto, 70 pp.
- Myers N, Mittermeier R A, Mittermeier CG, Da Fonseca GA, Kent J** (2000) Biodiversity hotspots for conservation priorities. *Nature* 403 (6772): 853–858. <https://doi.org/10.1038/35002501>

- Nadira YK, Mustapha M, Ghaffar M** (2019) The Indian mackerel aggregation areas in relation to their oceanographic conditions. *Sains Malaysiana* 48 (11): 2575–2581. <https://doi.org/10.17576/jsm-2019-4811-27>
- Reece JS, Bowen BW, Smith DG, Larson A** (2011) Comparative phylogeography of four Indo-Pacific moray eel species (Muraenidae) reveals comparable ocean-wide genetic connectivity despite five-fold differences in available adult habitat. *Marine Ecology Progress Series* 437: 269–277. <https://doi.org/10.3354/meps09248>
- Ward RD, Zemlak TS, Innes BH, Last PR, Hebert PD** (2005) DNA barcoding Australia's fish species. *Philosophical Transactions of the Royal Society B: Biological Sciences* 360: 1847–1857. <https://doi.org/10.1098/rstb.2005.1716>
- Whitley GP** (1948) Studies in ichthyology. No. 13. *Records of the Australian Museum* 22 (1): 70–94.
- Zainal Abidin DH, Mohd Nor SA, Lavoue S, A Rahim M, Jamaludin NA, Mohammed Akib NA** (2021) DNA-based taxonomy of a mangrove-associated community of fishes in Southeast Asia. *Scientific Reports* 11 (1): 17800. <https://doi.org/10.1038/s41598-021-97324-1>